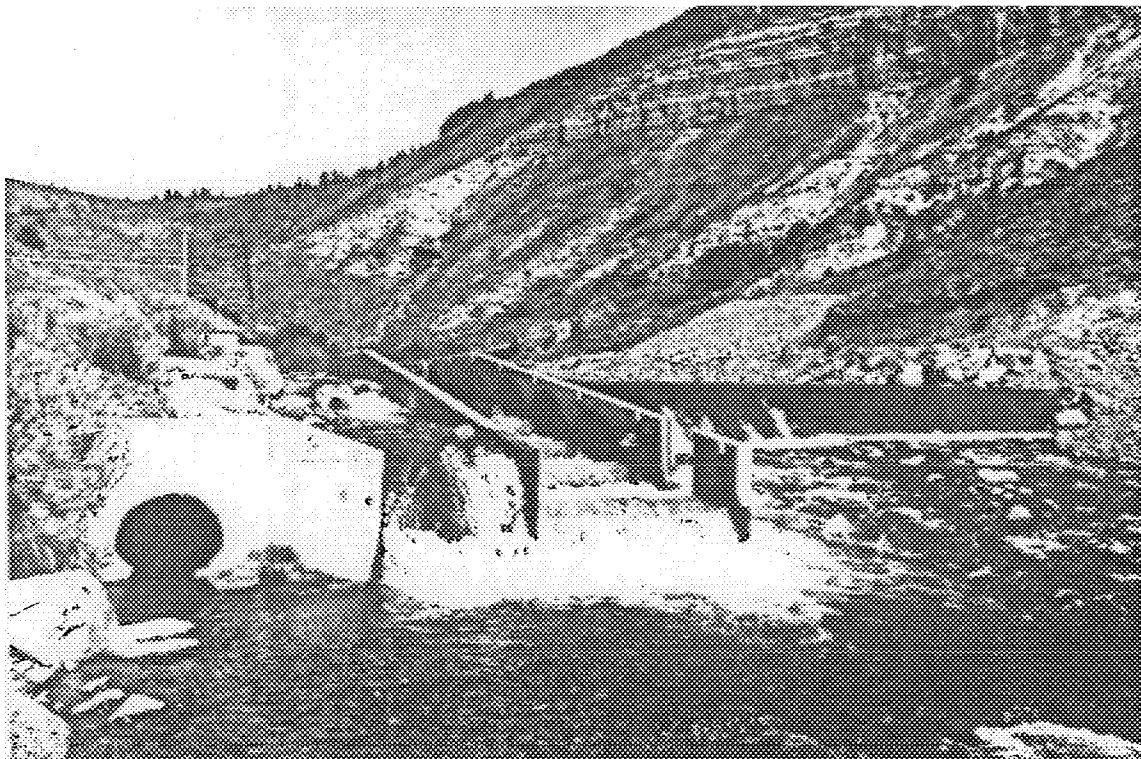


UNITED STATES DEPARTMENT OF THE INTERIOR
Fisheries Assistance Office
U.S. Fish and Wildlife Service
Vancouver, Washington

EVALUATION AND PROPOSED MODIFICATION OF
SHITIKE CREEK FISH LADDER ON THE WARM SPRINGS
INDIAN RESERVATION INCLUDING ENGINEERING DESIGNS,
COSTS AND SPECIFICATIONS



A cooperative study by:
U.S. Fish and Wildlife Service
and
Columbia River Inter-Tribal Fish Commission

MARCH, 1979

(Funded by: Bonneville Power Administration)

SPECIAL REPORT

EVALUATION AND PROPOSED MODIFICATION OF SHITIKE CREEK FISH LADDER ON THE WARM SPRINGS INDIAN RESERVATION INCLUDING ENGINEERING DESIGNS, COSTS AND SPECIFICATIONS

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Introduction

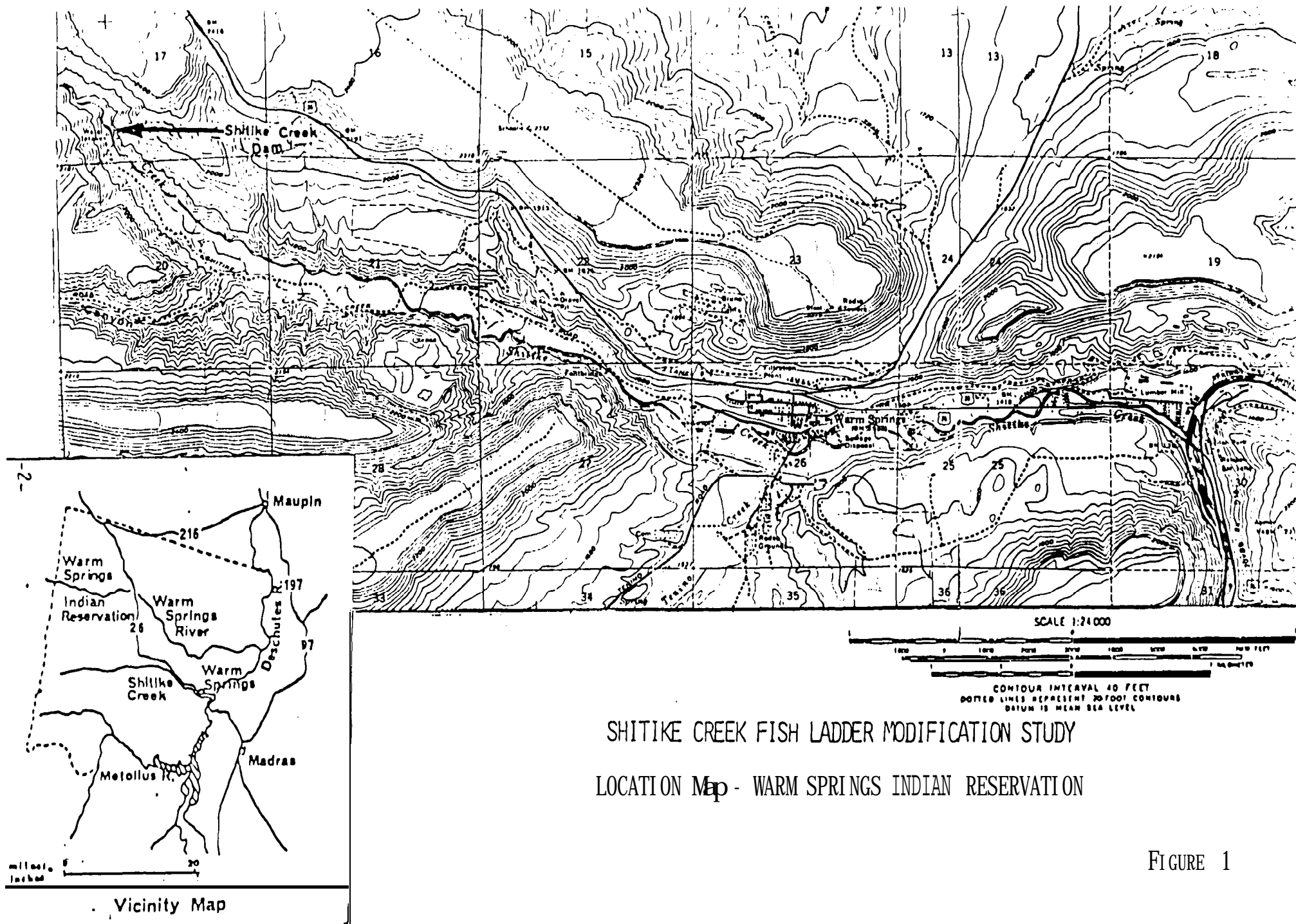
In FY-78, the Bonneville Power Administration (BPA) provided funds to the Fish and Wildlife Service (FWS) for a joint study with the Columbia River Inter-Tribal Fish Commission (CRITFC) to investigate passage problems associated with a fish ladder constructed on a domestic water supply dam located on Shitike Creek, on the Warm Springs Indian Reservation.

History

Shitike Creek originates in Harvey Lake near Mt. Jefferson, and flows 34 miles through the Warm Springs Indian Reservation, before entering the Deschutes River at river mile 96.8. In 1954 the Bureau of Sport Fisheries and Wildlife surveyed the stream and identified several problems inhibiting migration of anadromous salmonids in Shitike Creek. A mill pond diversion dam and a few unscreened irrigation diversions were located. Several log jams and falls were noted in the stream. Immediately the Tribe took steps to correct these problems and all barriers were removed from Shitike Creek.

A small domestic water supply dam including a fish ladder was built in 1965 on Shitike Creek approximately five miles upstream from its confluence with the Deschutes River (Figure 1). Investigations conducted by personnel of the Fisheries Assistance Office-Vancouver in 1974, determined that the Shitike Creek fish ladder was not providing effective upstream passage of adult salmonids. Fish passage was impeded for the following reasons:

- 1. Flow through the ladder is not efficient to attract fish to the ladder entrance, consequently adult fish are attracted to the base of the dam rather than the ladder entrance.**
- 2. The ladder entrance is located too far downstream from the base of the dam**
- 3. The ladder entrance does not have a holding and/or jumping pool.**
- 4. Improper gradient in the upper two sections results in shallow depths, making passage through these pools difficult.**



SHITIKE CREEK FISH LADDER MODIFICATION STUDY
 LOCATION Map - WARM SPRINGS INDIAN RESERVATION

FIGURE 1

Recommended Modifications

The Fish and Wildlife Service's Engineering Division in Portland, Oregon, conducted onsite inspections and surveys during 1978 in order to assess modification alternatives to improve fish ladder efficiency. As a result of these surveys, technical specifications, estimated 1978 construction costs, and final plans for modification of Shitike Creek fish ladder were prepared (Exhibit 1, 2 and 3 respectively). The estimated 1978 modification cost was 852,000, with an additional \$3,000 needed for engineering inspection costs. The major features of the recommended modifications are:

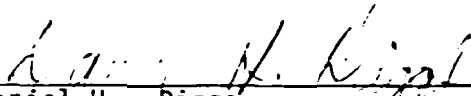
1. Construct three additional steps adjacent to the present ladder, bringing the ladder entrance nearer the base of the dam
2. Construct permanent jumping pool at the ladder entrance.
3. Divert additional attraction water into the fish ladder.
4. Install screens and gratings over the sides and tops of the ladder for protection of fish, and easy maintenance of head boards.

Justification

Shitike Creek supports runs of steelhead trout and spring chinook salmon. Excellent spawning gravel is found in the lower 19 miles of the creek, however because of poor passage at the dam, only the five mile reach below the dam receives significant use; the remainder is under utilized. Spawning ground surveys conducted in 1977 showed 93 steelhead redds below the dam and none above. In 1978, 50 redds were counted below the dam and 25 above. Use above the dam in 1978 was the result of temporary flood control work which improved fish passage conditions for a short period of time.

An efficiently operating fish passage facility at the dam would greatly increase anadromous fish production in Shitike Creek by making approximately 14 additional miles of excellent spawning habitat available.


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TECHNICAL SPECIFICATIONS

SECTION 1. GENERAL REQUIREMENTS

1A. SCOPE

The work to be performed under these specifications includes furnishing all labor, materials, equipment and supplies required for additions and modifications to an existing fish ladder.

1B. WATER QUALITY PROTECTION

The waters of Shitike Creek shall be protected from contamination by the Contractor's operations during all phases of construction. All waste or debris of any kind shall be placed and retained at a location above and beyond high water flows. The operation of construction equipment in flowing water shall be held to an absolute minimum. Extreme care shall be taken to assure that no petroleum products, grout, concrete or other deleterious material is allowed to fall, be wasted or otherwise enter flowing water.

SECTION 2. SITEWORK

2A. DEMOLITION AND REMOVAL OF EXISTING CONCRETE

Demolition and removal of existing concrete shall be accomplished without the use of explosives. All damage to existing concrete which is to remain in place, shall be repaired to a condition equal to that existing prior to beginning demolition operations. Repairs shall be by the Contractor with no additional cost to the Government.

Existing reinforcing steel exposed during removal of existing concrete shall be left in place where it will be embedded in new concrete. Reinforcing steel to be left in place shall be cleaned of all adhering material before being embedded in new work. Cleaning of rebars shall be by wire brush or other means approved by Engineer. Cleaning reinforcing steel with vibratory stools, hammers or other methods which may destroy bond between reinforcing steel and existing concrete will not be allowed. All material resulting from removal of existing concrete shall become the property of the Contractor and shall be removed from the site.

2B. EARTHWORK

The Contractor shall perform all excavating and backfilling necessary for and properly incidental to the completion of the work.

The Contractor shall be responsible for dewatering work areas and no extra payment will be made for water encountered in any excavation or other work area. Water removed from excavations or other work areas shall not be allowed to flow into the stream if it will violate Section 1.B

Excavations shall provide sufficient space for work and inspection on the forms. Excavations carried below the required depth shall be back-filled with concrete at no additional cost to the Government.

Backfill material shall be rock and granular material obtained from excavation. Backfill material within 3 feet of the structure shall contain no rocks larger than 6 in. in diameter.

Excavations shall be dewatered during backfilling. Dewatering shall limit the water depth to 1/4 the depth of the excavation or 6 in. whichever is less.

Backfill placed against one face of concrete walls shall not be placed until the concrete has developed sufficient strength to resist loads imposed by the backfill. Any abutting concrete walls, beams or slabs shall also have attained sufficient strength. In any case, the backfill placement shall not exceed the following schedule:

<u>Age of Concrete</u>	<u>Backfill Depth</u>
72 hours	1/3 wall height
7 days	2/3 wall height
21 days	full wall height

Any deviations from this schedule must be approved in writing by the Engineer.

All excess excavation not required for backfill shall be wasted above and beyond high water flows. Wasted material shall be graded and blended into adjacent ground.

SECTION 3. CONCRETE

3A. CONCRETE FORMS

3A.01 Materials

Forms shall be wood or metal. Metal forms shall have all bolt and rivet heads countersunk so that a plane, smooth surface of the desired contour is obtained.

Wood forms shall be sheathed or lined with plywood or tempered masonite so as to form even and uniform surfaces. Plywood forms shall not be used with the second ply exposed. Plywood panels shall be as large as possible.

Form ties shall be of approved round design, free from devices that will leave holes or depressions larger than 1-1/4 in. diameter and of a type that when forms are removed, shall leave no metal within 1 in. of finished surface.

3A. 02 Workmanship

Forms shall be used to confine the concrete to the shape, line and dimensions of the members, and shall be substantial and sufficiently tight to prevent leakage of mortar. Forms shall be adequate in strength, securely anchored and properly braced and/or tied together to maintain position, shape and alignment within the specified tolerances during all concrete placement and consolidation operations.

Gradual surface irregularities shall not exceed plus or minus 1/8 in. measured with a 5 ft. template and 1/4 in. measured with a 10 ft. template. Abrupt irregularities will not be permitted. Deviations from line, grade and dimensions shall not exceed 1/2 in. However, the minimum thickness allowed for any structural slab or wall shall be 1/4 in. less than dimensional.

The inside of forms shall be clean, free of encrusted grout and coated with a form release compound appropriate for the form surface and concrete finish required. Forms shall be thoroughly wetted before placing concrete. Under no circumstances shall form release compound be allowed to contact reinforcing steel or construction joint surfaces.

3A. 03 Removal

Forms shall be removed no sooner than 12 hours and not more than 24 hours after concrete has been placed.

3B. REINFORCING STEEL

3B. 01 Materials

Bars shall be of the sizes and shapes shown and shall conform to Federal Specification QQ-S-632, Type II, Class B40 or B60.

3B. 02 Workmanship

Fabrication and placement of all reinforcing steel shall comply with requirements of the ACI Building Code. All field bends shall be cold formed to templates meeting radius requirements of the ACI Building Code.

Before any concrete is placed, all reinforcing steel in the section or area to be poured shall be securely tied in place (alternate bar inter-sections minimum), checked by the Inspector and permission to proceed given by the Inspector. All concrete placed without permission from the Inspector shall be subject to removal and replacement at no additional cost to the Government.

3c. CONCRETE

3C.01 Concrete Mix

Concrete shall be ready-mixed concrete conforming to ASTM C-94 and the following:

28-day compressive strength	3,000 psi min.
Total water content	6 gal./sack max.
S l u m p	3 in. max.
Aggregate Specific Gravity	2.60 min.
Coarse aggregate size	1 1/2 in. max.
Cement.	Type II, low alkali only
Cement per cubic yard	6 sacks
Air entrainment	4 to 6%

Fine aggregate shall consist of natural sand, manufactured sand, or a combination of natural and manufactured sand. It shall be uniformly graded from 0 to No. 4 sieve designation to provide a fineness modulus from 2.5 to 3.0. Fine aggregate will be rejected if: (1) deleterious substances such as shale, clay lumps, mica, loam and soft particles exceed 3% by weight; (2) the portion retained on a No. 50 screen shows a weighted average loss of more than 8% by weight when subjected to 5 cycles of Sodium Sulphate test for soundness; (3) portion passing a No. 100 sieve is 5% or more by weight or (4) portion passing a No. 200 sieve is 1% or more by weight.

Coarse aggregate shall consist of gravel or crushed stone. It shall be uniformly graded from No. 4 to 1-1/2 in. sieve designation (square mesh opening). Coarse aggregate will be rejected if: (1) deleterious substances such as shale, clay lumps, organic material, soft particles, and material passing No. 200 screen exceed 2% by weight; (2) the L.A. rattler test results in 10% weight loss at 100 revolutions or 40% weight loss at 500 revolutions; (3) the Sodium Sulphate test for soundness results in an average weighted loss of more than 10% by weight when subjected to 5 cycles; and (4) portion passing a No. 200 sieve is 0.5% or more by weight.

3C.02 Placing Concrete

No concrete shall be placed except in the presence of the Inspector, and no concrete shall be placed when the air temperature is below 40°F. The temperature of the concrete at time of placement shall not be above 80°F. The Inspector shall be notified of intent to pour 24 hours before pour is to start.

Concrete shall not be placed without adequate cover during expected rainy periods. Cover materials shall be at the job site, ready for installation before concreting is started and shall remain in place until the concrete has set sufficiently to resist any damage to the finish from rainfall.

During the curing period when there is likelihood of freezing temperatures, suitable and sufficient measures must be provided to maintain all concrete surfaces at a temperature of not less than 50 degrees F. for a period of not less than 5 days after concrete placements. All necessary materials for covering or housing must be on the work site before concrete work is started and must be effectively applied or installed. Where artificial heat is employed, special care shall be taken to prevent the concrete from drying by maintaining the curing procedures. All concrete placed in the forms shall have material temperature range between 40 and 80 degrees F.

Water shall be removed from within forms and excavations before and during placement of concrete.

Concrete shall be deposited in all cases as near as practicable directly in its final position and shall not be caused to flow in the mass in a manner to permit or cause segregation. Freely dropping the concrete vertically a distance of more than 5 ft. or depositing a large quantity at any point and running or working it along the forms will not be permitted.

Concrete shall be consolidated with the aid of mechanical vibrating equipment supplemented by hand spading and tamping. Vibrating equipment shall be of the internal type and shall at all times be adequate to properly consolidate all concrete.

Concrete shall be placed within 1-1/2 hours of commencement of mixing. In warmer weather, the time limit may be reduced if the concrete appears to be losing plasticity.

3C.03 Curing Concrete

All concrete shall be kept continuously (not periodically) wet for at least 5 days after placing by covering with water-saturated material or by a system of perforated pipes, sprinklers or porous hose, or by any other approved method which will keep all surfaces to be cured continuously wet.

In lieu of water curing, a curing compound equal to W.R. Grace & Co. "Horncrete 30D", conforming to ASTM C-309 Type 1 with fugitive dye, will be permitted provided (1) all concrete finish work has been completed prior to application, (2) concrete surface has been kept moist until application is complete and (3) none is applied to any concrete surface to receive mortar or where concrete bonding is required including the surfaces of all construction joints. The curing compound shall be applied in strict accordance with manufacturer's recommendations to cover not more than 200 sq. ft. per gallon.

3C.04 Concrete Finishing

Finishing operations of formed surfaces shall begin immediately upon removal of the forms and shall be completed within 8 hours following form removal.

The tops of walls shall be screeded to proper elevations and alignment and shall be floated. After floating, the tops shall be steel troweled and the top exposed corner shall be tooled with a 3/8 in. radius edging tool. In lieu of edging wall tops may be chamfered.

Immediately after form removal, all fins, unsightly ridges and projections shall be removed from all surfaces to be exposed and extending to 12 in. below finish grade. All tie rod holes shall be mortar packed.

Slabs shall be floated and steel troweled. Where top edges are exposed, they shall be edged with a 3/8 in. radius edging tool. Dry topping will not be allowed.

3C.05 Rejected Concrete

Concrete not conforming with the specifications or concrete damaged from any cause and any concrete which shall be found defective by reason of the Contractor's operation at any time before the completion and acceptance of the work shall be removed and replaced by the Contractor with acceptable concrete. All costs resulting from the removal and replacement shall be borne by the Contractor.

SECTION 4. GROUTING

4A. MATERIAL

Grout for setting anchor bolts, dowels, wall pipes, pipe supports, machinery base plates and structural bearing plates shall be a waterproof non-corrosive and non-shrink grout equal to Embeco 636 Grout.

4B. WORKMANSHIP

All grouting shall be performed in accordance with the manufacturer's instructions for mixing and placing.

SECTION 5. MISCELLANEOUS METALS

5A. GENERAL

All steel shall be free from mill scale flake, rust and pitting. All steel to be galvanized shall be hot dipped galvanized in accordance with ASTM A-123. Galvanizing shall be after fabrication.

5B. MATERIALS

5B.01 Structural Steel Shapes, Plates and Bars

Structural steel shapes, plates and bars shall conform to Federal Specification QQ-S-741.

5B.02 Hardware

Hinges shall be extra heavy wrought steel, 3 in. by 3 in. by .130 in. thick blank hinges with loose stainless steel pin with hex head brass set screw. Hinge leafs shall be galvanized after welding to gratings and angles.

5B.03 Grating

Grating shall be Gary Welded Steel Grating Type GW with 1-1/2 x 1/8" bearing bars 1-3/16" O.C. Grating shall be fabricated in special panel sizes as shown. Panels shall be galvanized after fabrication.

5B.04 Fasteners

All bolts, nuts and washers shall be galvanized, cadmium plated or stainless steel. Cinch anchors shall be equal to Phillip Red Head non-drilling flush anchors.

5B.05 Expanded Metal

Expanded metal shall be U. S. Gypsum Carbon Steel Flattened Expand-X Style 3/4" - No. 9. Expanded metal panels shall be fabricated into panel sizes shown with edges welded to bars and/or shapes as shown. Panels shall be galvanized after fabrication.

5c. FABRICATION

Field welds of galvanized steel components will not be allowed unless so indicated on the drawings and all such field welds shall be painted with Galvacon or equal.

The finished diameter of bolt holes shall not be more than 1/16 in. larger than the nominal diameter of the bolt unless otherwise shown.

On all exposed metal surfaces all cuts, drilling, welds, etc., shall be smooth free of burrs, scale, jagged edges, etc. All grating cuts shall be saw cuts.

All welds shall be continuous and to the full strength of components unless specifically noted otherwise.

All shop fabrication shall be to the shapes and dimensions shown within 1/16 in.

5D. INSTALLATION

Embedded items shall be securely fastened in place to prevent displacement during placing and finishing. Tolerance in the finished work shall be 1/4 in. for horizontal location dimensions and 1/8 in. for elevations;

however, all metal surfaces and edges shall be flush with adjacent concrete surfaces where applicable.

Movable items shall operate smoothly and easily without Binding and fit the mating parts at all appropriate locations and orientations.

SECTION 6. CARPENTRY

Stoplogs shall be 4 in. in 6 in. No. 1 grade Douglas Fir graded in accordance with UBC Standard 25-3 or 25-4.

ESTIMATED COST BREAKDOWN FOR SHITIKE CREEK FISH LADDER IMPROVEMENT

June 1978

MOBILIZATION AND DEMOBILIZATION \$ 5,000

DEWATERING AND WATER DIVERSION 5,000

DEMOLITION AND REMOVAL OF EXISTING CONCRETE

Remove 7 x 5 x 2/3 = 24 ft. @ \$12.50/ft.³ = \$300

Disposal 100 400

EARTHWORK

Excavation

4.5' x 22' x 30' x 1/27 = 110 C.Y. = 1 crew day

Cranew/clzmshell 320

lopr 150

1 Oiler 125

1 Foreman 150

3 per diem 75

Mob and Demob 500

\$1320 x 1.25 1,650

Backfill

Estimte same as excavation 1,650

CONCRETE

Slabs and cutoff Walls

Keyways 100 @ \$.88/l 88

Edgeforms 100 @ \$4.92/l 492

Drill & Grout rebar 17 1/2" @ \$20/ea 340

Screedchairs & bolts 200

Reinforcing steel 1/2 ton @ \$720/ton 360

Dowels 75 - #6 @ #3.95 300

Concrete 15 C.Y. @ \$40/C.Y. 600

Place concrete by pump & vibrate 600

Screed, float, trowel, broom

600 @ .85/l 510

Cure 15

3,505

Walls & Elevated Slabs

Bushhammer contact area of existing

concrete 125 @ \$1.25/l 156

Drill & grout anchor dowels 35 @ \$20/ea 700

EXHIBIT 2
SHEET 1 OF 4

ESTIMATED COST CONTINUED

CONCRETE (cont'd)

Walls & Elevated Slabs	
Drill & install expansion bolts	
45 @ \$20/a	900
Install 9 anchor bolts @ \$8./ea	72
Keyways 80' @ \$.88/1	70
Form 1476 @ \$3.32/1	4900
Reinforcing steel 1700# @ \$820/ton	697
concrete 20 C.Y. @ \$40/C.Y.	800
Place concrete by pump & vibrate	
(2 days)	1200
Screed, float, trowel, broom 280 @ \$.85/.	238
Finish walls & plug tie holes 900 @ \$.75/1	675
Cure	35

Concrete Total

\$ 1398

MISC. METAL

Trash rack 2000# @ \$1.25/#	2500
Fish SCREEN 460# @ \$1.25/#	575
Walkway Grating	
9'-3" wide x 6' long panels	
hinged to 9'-3" wide x 2' long	
panels hinged to one end 6 @ 650/ea	3900
9'-3" wide x 6' long panels hinged	
to 9'-3" wide x 2' long panels	
on both ends 1 @ \$730	730
Grating Supports	
1 @ 525# = \$1.75/#	920
Expand & welded to support	80
Installation	100
1 @ 349# @ \$1.75/#	611
Expand & welded to support	40
Installation	100
3 @ 369# @ \$1.75/#	2079
Expand & welded to supports	240
Installation	600
1 @ 398# @ \$1.75/#	697
Expand & welded to support	80
Installation	200
2 @ 400# @ \$1.75/#	1400
Expand & welded to support	160
Installation	400

EXHIBIT 2
SHEET 2 OF 4

ESTIMATED COST CONTINUED

MISC. METAL (cont'd)

Side Panels

12 @ 28#/ea @ \$1.75/#	\$ 588
Expand x 12 A 6 x 4 @ 133 x \$1.25	480
Welding & cutting \$1.25 x 12 x 25	400
Installation 12 @ 100/ea	1200

Wedded angles w/gratings

2" x 2" x 1/4" 8' long w/2' 3"	
hinged grating 4 @ \$45./e	180
2grating panels @ \$255/m	510
Installation2@100/ea	200

2" x2 x1/4 s 3' long w/1'4" hinged	
grating 2angles	34
1 grating panel	50
Installation	100

Railings 2" x 2" x 3/4" tubing

1 peice 8' long 2 posts embedded	
Mat'l	260
Installation	50

1 piece 4.5' long 1 post embedded	
Mat'l	140
Installation	50

1 piece 4.5' long 1 post embedded 6	
1 post surfaced mounted	
Mat'l	185
Installation	50

1 piece 18.5' long 1 part post & 2	
posts embedded	
Mat'l	305
Installation	50

1 piece 18' long 1 part post & 3 posts	
surface mounted	
Mat'l	530
Installation	75

1 piece 58' long 1 part post 6 8 posts	
surfacemounted	
Mat'l	1608
Installation	300

ESTIMATED COST CONTINUED

MISC. METAL (cont'd)

Railings 2" x 2" x 3/4" tubing

1 piece 9.33' long no posts

Mat'l

\$ 200

Installation

50

1 piece 40.25' long 6 posts

surfacemounted

Mat'l

1126

Installation

225

MISC.METAL TOTAL

\$ 24,358

CONCRETE TOTAL

13,948

TOTAL

\$ 52,009